

ESDU SPB-M8-1

Determining the mechanical properties of aspheltene films – Sept 08 update

Unamended
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Sub-project B

Interfacial and Rheological Properties of Asphaltenes Investigated using AFM

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Sept 2008

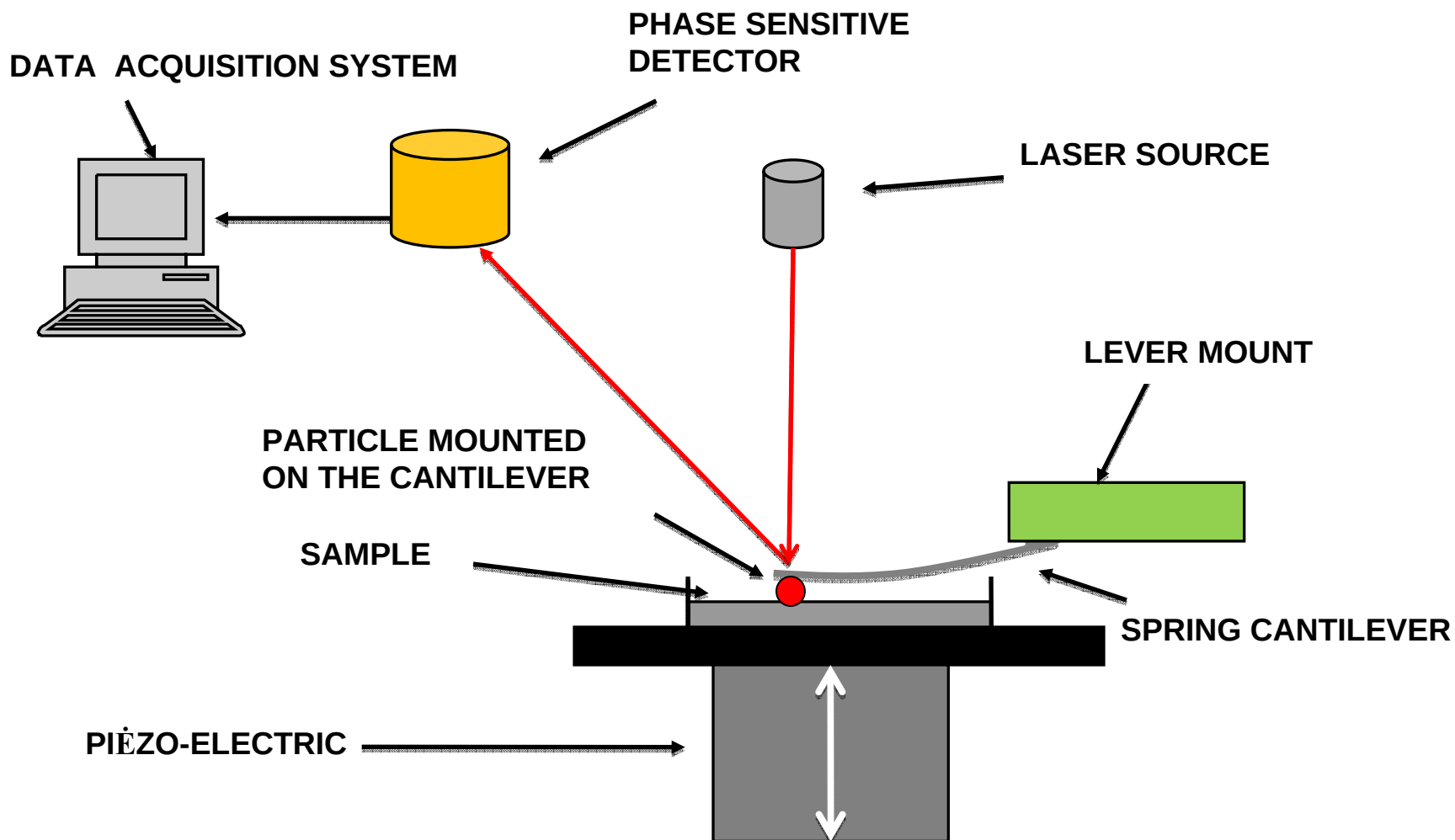
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Objectives

- Investigation of the deposition of asphaltenes onto the surfaces of reservoirs and heat exchangers through monitoring
 1. Adsorption and adhesion of asphaltenic materials
 2. Rheological properties of asphaltenes, such as shear stress, and viscosity of deposited materials at the interface
- Exploitation of an Atomic Force Microscopy (AFM)
 1. Measuring the interaction forces between asphaltenic particles
 2. Stress-Relaxation of asphaltenic surfaces

Atomic Force Microscopy Setup

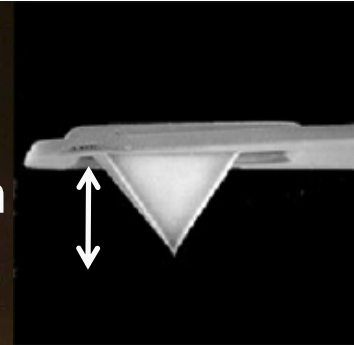


Cantilevers

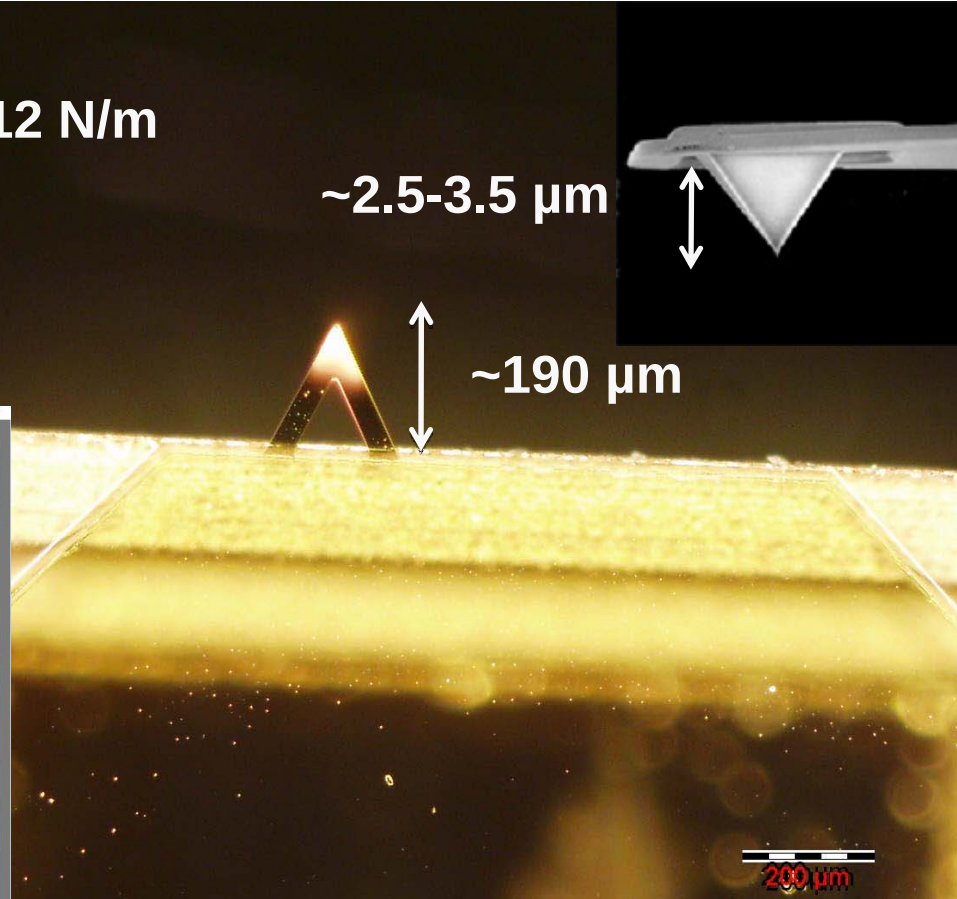
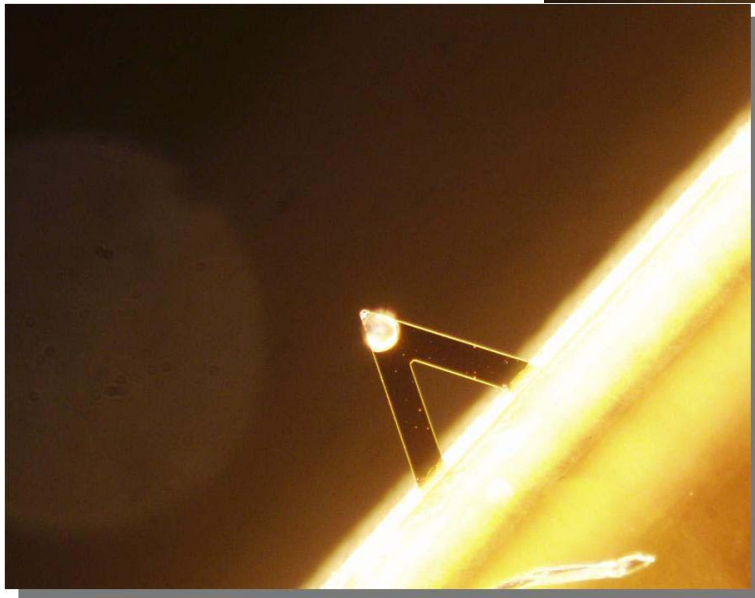
$K = 0.12 \text{ N/m}$

$\sim 2.5\text{-}3.5 \text{ }\mu\text{m}$

$\sim 190 \text{ }\mu\text{m}$

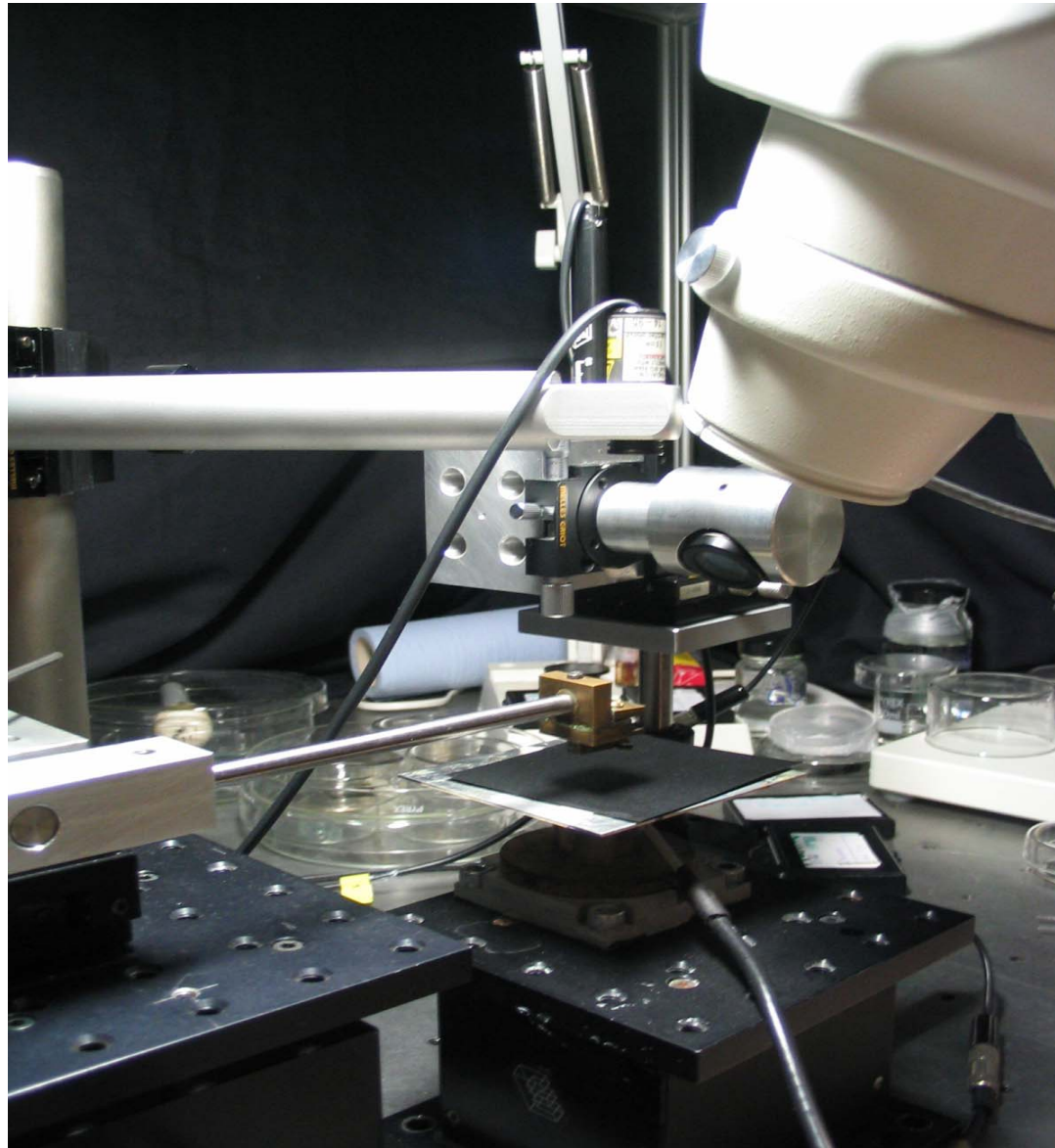


Particle mounted
on the Cantilever



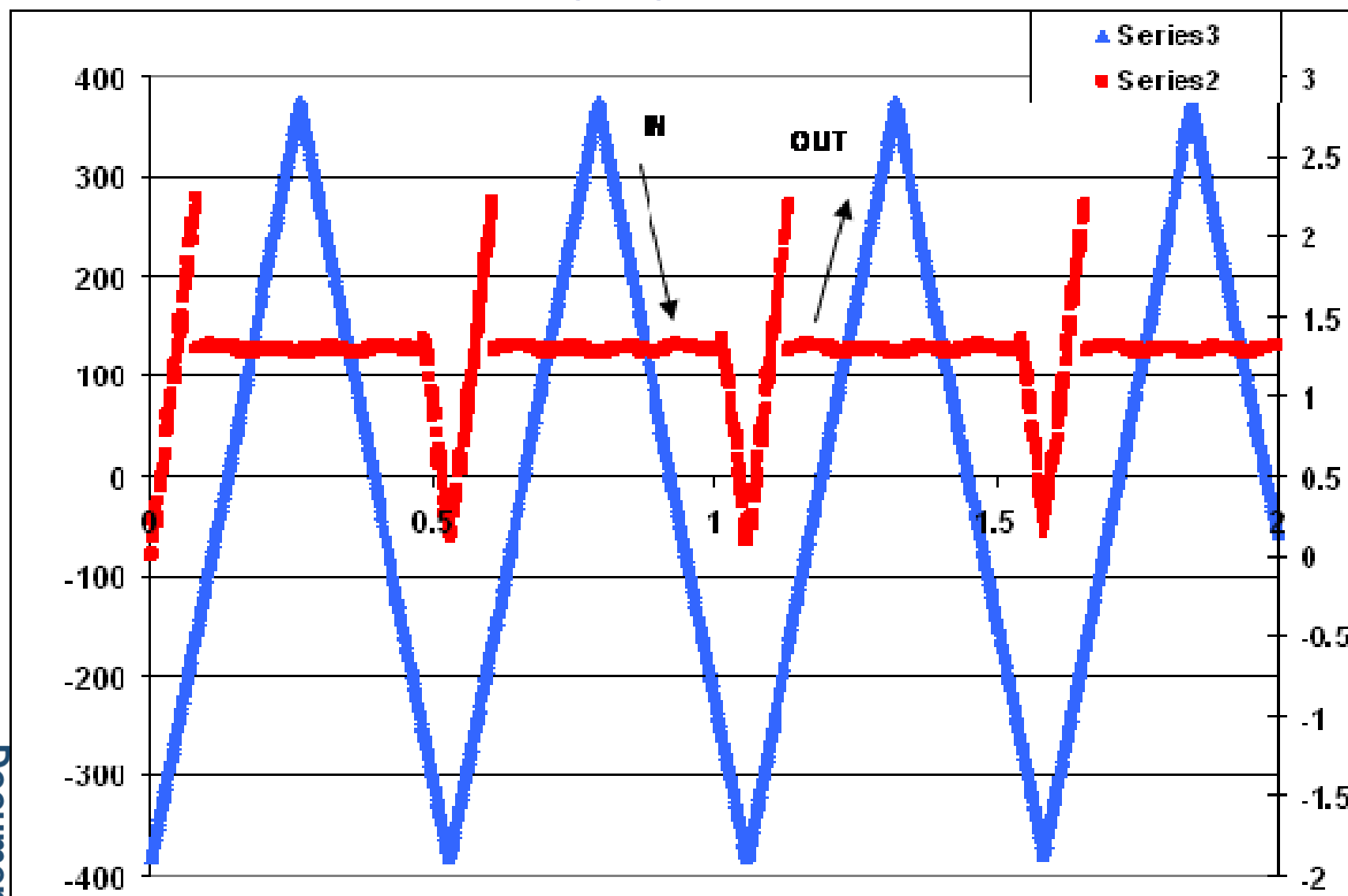
Cantilever with tip (Si_3N_4)

Custom-Made Atomic Force Microscopy



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Interactions Between Maya Asphaltenes and Polystyrene



First Stage

- Measurement of the *Young's modulus* of elastic materials to establish a model to estimate the *modulus* of asphaltenes; e.g.:

1. Polydimethylsiloxane (PDMS)

- Stress-Relaxation experiments on the visco-elastic surfaces using glass particles 30-40 μm or cantilever with a tip at a range of amplitudes